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# LOGISTICS CONCEPT IN PHASES OF DESIGN IN AUTOMOTIVE INDUSTRY

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[1] *HELLA Autotechnik, Mohelnice*

**ABSTRACT:** Design process in modern companies is process with strict rules. Aim of design process is to decrease of failure risk and design cost and to increase quality. Logistic process is a part of this process. In next text are presented two design processes and design of logistics concept in automotive industry.

**KEY WORDS:** Optimization Product lifecycle, logistics concept

## 1 INTRODUCTION

Time for design of new cars is shortened. It is valid for design all single parts of car. From this exist in all automotive suppliers design system of new parts. The name of this system is in companies different, but the goal is the same: design the great cheapest product in the shortest time. But all products must be with excellent quality. Part of this process is logistics concept.

The logistics concept is an overall and multi-dimensional model of the logistics system. The logistics concept combines the dimensions of material flows, chains of activities and different views on the complex logistics systems into a simple qualitative and visual grid. [8]

Developing logistics concept is a creative and useful process where the participants acquire an understanding of the causal relationships between activities across functional, organisational and system boundaries. [8]

## 2 DESIGN PROCESS AT SIEMENS ELEKTROMOTORY, S.R.O.

Siemens Elektromotory is producer of induction motors. In Siemens is design system named PLM (Product lifecycle management). Part of this system is described in organization instruction OV 512 Produkt-Entstehungsprozess. In Siemens PLM defines the lifecycle of a product from the first idea to the phase out [3]. The product is usually designed for all customers.

The PLM is part of process house. The other processes of the process house are: Management process (planning and controlling, audits...), Customer relationship management, Supply chain management, Other processes (human resources, environment ...).

Phases of PLM are:

- Planning and management of product portfolio
- Define – definition of product (quality, feature)
- Realize – design [6], approve, place in the market
- Commercialize – customer relationship management, supply chain management
- Phase out – coordinate phase out

The PLM is in Siemens new and a lot of people don´t see advantages of this system.

## 3 DESIGN PROCESS AT HELLA AUTOTECHNIK, S.R.O.

Hella Company is producer of headlamps for car. In this company is design system named PEP (Produkt Entstehungsprozess). This system is described in organisation instructions HP-GL 541 and HP-C-304. In this system isn't involved phase "marketing research". Requirements of customer for new headlamp are in document "Lastenheft" (Assignment). In this document is relevant marketing information (customer, terms of start and end of serial production, planned capacity, description of headlamp).

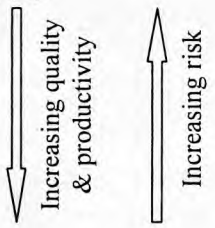
The design process last usually for two years. But today is press from customer to shorten this time. This short time doesn't permit Hella company make big mistakes. PLM (PEP) process helps Hella Company to decrease risk of failures. PLM process is "Cookery book" for project team.

During design of new product is necessary to design logistics concept. Logistics concept is part of all phases. Wrong logistics concept could bring problems with quality during lifecycle of product.

## 4 PHASES OF PEP AT HELLA COMPANY

In Hella Company is design process (PEP) divided in five phases [5]:

- Quotation
- concept & detailing
- Means of production build
- Product and process qualification
- Rump up (Serienanlauf)




These phases are in figure 1. Phases coincide in the time plan.

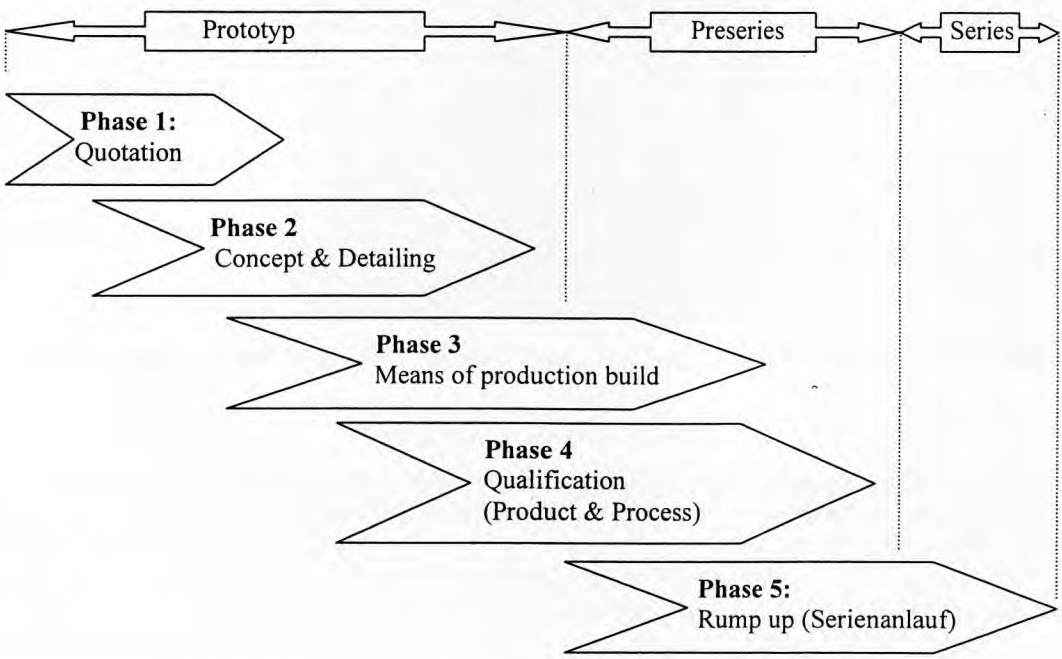



**Figure 1** Phases for product lifecycle management in Hella Company

## 5 LOGISTIC CONCEPT IN THE PHASES OF PRODUCT LIFECYCLE IN HELLA

Headlamp development is running over the spiral. In single phases of development we make the same operations again. Only the accuracy is increasing. It is similar to Darwin´s evolution of species. In this paper is described the design of new logistics concept (project Headlamp VW POLO A05, SOP 03-2008).

Development of logistics concept in Hella involves first of all packing and transport (parts and products-headlamps) and calculation.

### Phase 1 – Quotation

Part of technical specification is first logistic and packaging concept for headlamps. For packaging concept are available 3D data (only outer form of headlamp). These data aren´t finished. The packing is designed after another project. In this phase is used method "Analogy". This method compares two or more objects – other headlamps – in certain badges (form, size, weight). Way of transport is agreed easier. In the world are only a few car producers and Hella is old supplier of headlamps. So the system of transport is overtaken from another project.

For followed project were proposed three solutions. The plan was to deliver headlamps in Spain (returnable packaging) and in South Africa (no returnable packaging). Third possibility was to deliver only some parts and final assembly made in South Africa (request for localization). This variant was for Spain unnecessary. Today Hella deliver in Spain from central Europe and Spain is in EU as Czech Republic.

Proposed packing systems:

A) Bulk returnable
- Exterior packaging – container with cover
- Inner packaging – 3 layers per single box, 9 parts per layer
- 27 pcs. per 1 container

B) Bulk no returnable (expendable) – wooden pallet, strapping tapes, lover, paper boxes –27 pcs. per 1 pallet (Packaging like for Japan)

C) Was prepared list of parts for South Africa (SA) and logistics concept for these parts. The rest of parts were planned to produce in Africa.

For quotation according point A) were 4 variants (Fig. 2). Recommended variants from figure 2 are B) and C). For these variants was logistic cost precalculated.

Hella has won only project Polo A05 with bulb H7 (ES) for Spain. The project POLO A05 with bulb H7 (LES) for South Africa is another project.

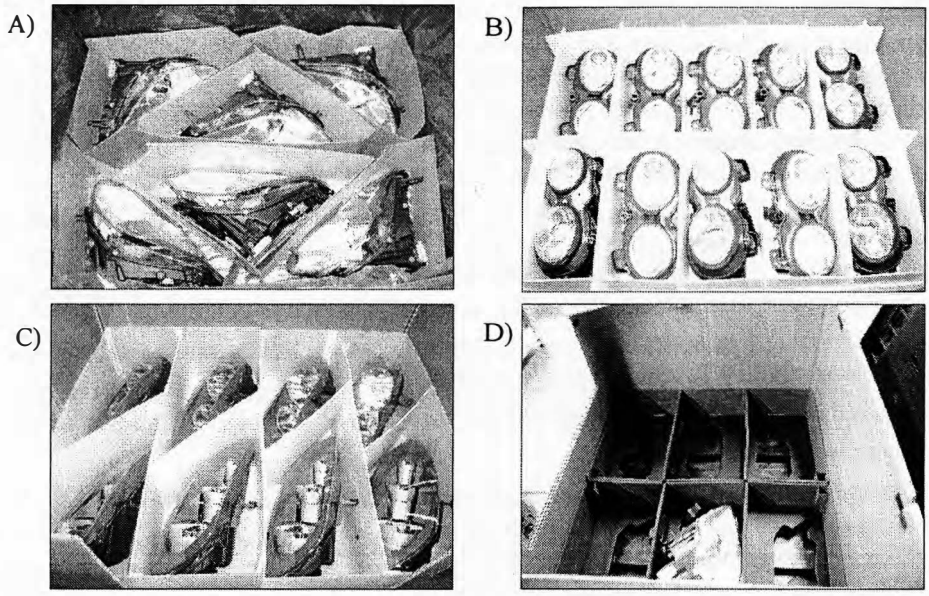



**Figure 2** Interior of exterior packing returnable system – variants


**Figure 3** Container Plastic box 1200x1000x1000 mm (3x8, total 24 headlamps), returnable system

### Phase 2 - Concept and detailing

In this phase is developed first real form of headlamp with all inner parts (in CAD system). First headlamp is produced by 3D printing technology (A-Muster). This headlamp is not from serial material. With this real model we can check all mechanical function but couldn´t check optical quality. In accordance with real 3D model is headlamp released by customer.

After customer releasing of the A-Muster are first tools manufactured (Aluminium tools) and first parts are produced (B-Muster).

With headlamps (B-Muster) was prepared complete logistic concept. In the first step we checked maximal load for external packing of headlamp. First packing systems are produced and tested. For this project were prepared two versions (see fig. 2: B, C) of packing.

In the second step we prepared list of parts (Bill of material). In the list are parts divided in a few groups (make or buy):

- purchased standard parts –old logistics concept is checked
- purchased new parts – logistics concept must be prepared by supplier and released by Hella
- produced parts (inside Hella) – old logistics concept is checked
- produced new parts (inside Hella) – new logistics concept must be made and released

For all parts must be appointed producer. For parts produced inside Hella is prepared internal logistics concept. It is cheap packing only for internal use (only for transport inside factory). For small parts are defined plastic boxes (for example EkoBal). For bigger parts are defined Gitterboxes and Roll containers with special racks and auxiliary packing material (PVC bags ...).

Packaging of strategic parts is strict watched. Strategic parts are decorative parts (reflector, bezel and lens) and electronic (LWR, control units, harnesses).

In the end of this phase must be finished packaging concept.

In this phase we used three methods:

- experiment – first parts were placed in proposed packing (A-Muster, B-Muster)
- brainstorming – about problematic parts, discussion with experts
- FMEA – analyse of proposed packing concept [2]

**Phase 3 - Means of production build**

In this phase is tested external and internal logistics concept with first samples of serial packing. In the serial packing are parts delivered and transported. In the end of this test are parts checked, all damages of parts must be find in this phase. Decorative parts are checked in decorative surfaces. Housings are checked for deformation during transport and storage. Electronic parts mustn't be electrostatic damaged.

The packing of Headlamps is checked. All variants of packing were tested. The headlamps were sent to the customer in new boxes. The customer checked new packaging. In accordance with this test is determined final packaging concept and serial packaging of headlamps can be order (fig. 2 variant B).

Description of this external packaging:

| | |
|---|---|
| Producer: | NEFAB |
| Dimensions (mm): | external: 1200 x 1000 x 970<br>internal: 1160 x 960 x 765 |
| Weight: | black pallet 16 kg,<br>grey ring 12 kg,<br>black cover 10 kg |
| Material: | ring: polypropylene<br>pallet and cover: polypropylene, |
| Max load: | 200 kg/box |
| Stacking: | 5 boxes |
| Truck capacity: | 78 Boxes "mega trailer",<br>84 Boxes "jumbo trailer" |
| Internal code: | PB3, 491.430-14 |
| Note: | 4 locks on pallet, 4 locks on cover<br>2 pockets for documents. |

Packaging concept for headlamps must be released by customer. Logistics concept for parts must released purchasing department and manufacturer.

In this phase was finished Logistic cost calculation (confidential) for external packaging. This calculation is composed from three parts:

- Basic information (Supplier name, part number, Description, volume headlamps per year, production location, transport distance (2200 km), contact person)
- Container information (type of container – special, returnable, description of handling unit, weight of container, dimensions, parts per container, container demand per day (55 / working day), calculated circulation days, container quantity of process chain, cost for design of container, Investment per serial container, total investment, total invest per parts)
- Transportation costs (Type of transport (Jumbo trailer – 84 container/trailer), frequency of delivery, total transportation costs, total transport costs per part)

### Phase 4 - Product and process qualification

During serial production are checked all deliveries (parts and headlamps). In this phase are made improvements of logistics concept. In the end of phase 4 are internal logistic and process audits.

### Phase 5 - Rump up (Serienanlauf)

Project is finished and closed. The project is sold to the producer (another project team). Logistics concept must be OK.

## 6 CONCLUSION

The paper described the design of new product in Siemens and in Hella companies. In the second step the paper verifies the design of logistics concept in phases of design in automotive industry. The project POLO is today in phase 3 and 4. Logistics concept is in phase qualification. Packaging system is ordered. The project isn't already finished (start of serial production is in March 2008).

Conclusion: described development system of Logistics concept is possible to use for new projects.

Improvements: for new project were unite the forms (Czech forms were different from German forms).

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**Reviewer:** doc. Ing. Radim Lenort, Ph.D.